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DRAWINGS ATTACHED.

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## COMPLETE SPECIFICATION.

## Improvements in or relating to Electrically Propelled Vehicles.

We, G & M POWER PLANT COMPANY LIMITED, a British Company, of Magnet Works, White House Road, Ipswich, Suffolk, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electrically propelled vehicles of the type in which the electric current for driving the vehicles is obtained from storage batteries carried by the vehicles.

Electric vehicles of this type have great advantages for many purposes, such as house-to-house delivery of goods in towns, particular advantages being their relative quietness and the absence of exhaust fumes. They have, however the disadvantage that their range is limited by the capacity of the storage batteries, which are very heavy.

It is the object of the present invention to provide an electrically propelled vehicle of the battery operated type in which the range of operation is substantially increased without increasing the weight of the vehicle to the same extent as would result from increasing the battery capacity.

According to the present invention, in a battery operated electrically propelled vehicle having provided thereon an electric motor to drive the road wheels of the vehicle, a storage battery to supply electric current for driving the said motor, an electric generator, and an internal combustion engine serving only to drive the electric generator, which generator is connected to the said storage battery so as to effect charging thereof, the engine and generator are contained in a closed casing which is provided with a layer of sound insulating material and ventilated.

Preferably, the internal combustion engine employs propane gas as fuel, and the said engine may be governed to run at a fixed speed.

Further, according to the invention, a battery charging set for use in a vehicle according to either of the last two preceding paragraphs may comprise a sheet metal casing which is provided with a layer of sound insulating material and ventilated, an internal combustion engine and an electric generator mounted in said casing, and means for conducting exhaust gases from said engine to a silencer outside said casing.

The sheet metal casing may include a bottom wall and a side wall hinged to the said bottom wall, a base slidable in guides on said bottom wall and carrying the engine and generator, and guide extensions formed on the internal surface of said side wall so that when the said side wall is moved to a position co-planar with the bottom wall, the engine and generator can be slid out on to said side wall for inspection and servicing.

The invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a perspective view of an electrically propelled vehicle embodying the invention;

Figure 2 is a diagram showing the electrical connections; and

Figure 3 is a perspective view, on a larger scale, of the generator, the internal combustion engine driving the generator, and the casing for housing the said generator and engine, the casing being shown open and the generator and engine being withdrawn for inspection or servicing.

Referring to Figure 1 of the drawings, the electrically propelled vehicle is shown as a

milk float having a forward driving cab 10 and a rear platform 11 covered by a canopy 12. The rear wheels 13, are driven by a conventional direct current electric motor 14 (Figure 2), the current for the electric motor being derived from storage batteries 15 housed in casings at the sides of the vehicle, one such casing being shown at 16 in Figure 1. Provision is made for connecting the batteries to a mains-operated battery charger through a socket 16a (Figure 2), so that they can be recharged using mains electricity when the vehicle is not in use, and there is also provided on the vehicle an electric generator 17, driven by an internal combustion engine 18 to provide charging of the batteries when the vehicle is in use. The said electric generator and internal combustion engine are housed in a sheet metal casing, shown at 19 in Figure 1 and mounted beneath the rear platform 11 of the vehicle, the engine using, as fuel, propane gas drawn from a gas container 21 mounted alongside the casing 19.

Referring now to Figure 3 of the drawings, the sheet metal casing 19 is of substantially rectangular shape and has its side wall 22, which faces the rear of the vehicle hinged to the bottom wall 23 thereof along the lower edge of the said wall 22. A base 24 on which are mounted the internal combustion engine 18 and the electric generator 17 both mounted on slide members 25 engaging in channel-shaped guides 26 in the bottom wall 23 when the base lies within the casing 19, corresponding channel-shaped guides 27 being provided in the side wall 22 which form continuations of the guides 26 when the wall 22 is lowered to the position shown in Figure 3. The base 24 carrying the generator 17 and engine 18 can thus be slid out, when the wall 22 is in that position, to the position shown in Figure 3, where it is accessible for inspection and servicing.

The engine 18 is enclosed in a cowling 28, and the generator is enclosed in a cowling 29. A fan 31 draws air through a grille 32 in the wall 22 of the casing 19 and directs it through the cowlings 28 and 29 to an outlet duct 33 which, when the base 24 is in position in the casing 19, connects with outlet ducting 34 in a wall of the said casing. An exhaust pipe 35 for the engine is adapted for connection, when the engine and generator are in position in the casing 19, to an opening in the casing leading to a silencer mounted outside the said casing.

The engine 18 is provided with a speed governor to maintain a substantially constant speed, and with electric self-starting equipment drawing current either from the vehicle propulsion batteries or from a separate starter battery.

The carburetter of the engine is connected through a suitable conduit to a valve

36 mounted on a wall of the casing 19 when the engine is in position in the casing, the valve being in turn connected to the gas container 21 and being adjustable to control the gas supply.

An electrical socket connecting unit 37 mounted in a wall of the casing 19 and adapted to receive, inside the casing, a plug 38 on the end of a twin cable connector 39 leading from the generating set, is connected externally of the casing 19, by suitable conductors, to the batteries.

The casing 19 is provided with a layer of sound insulating material.

As an example of the benefit obtained by using a battery charging system according to the present invention, the results of a test carried out with vehicles having a load capacity of ten hundredweight and with a generator having a maximum output of 2,000 watts are quoted below.

The normal range of the vehicles, starting with the batteries fully charged, was 35 miles, less a reduction of three miles for each fifty stop-start sequences. The range, with the generator in use, was found to be increased by 60% to 100% depending on the type and battery capacity of the vehicle.

Tests carried out on one particular vehicle gave almost double the range with approximately a 50% increase in the number of stop/start sequences.

Although the generator does not necessarily supply the battery at a rate sufficient to balance the discharge during running it can, if the battery charge falls too low, provide sufficient re-charging to enable the vehicle to start and run for some time, thus enabling it to reach its depot without assistance even if it exceeds its normal range of travel.

By suitable choice of the proportion of a journey time during which the generator is maintained in operation, the battery can be brought to substantially the desired minimum state of charge at the end of each journey, so that most of the battery charging is done by connecting it to the electric mains at its depot, thereby economising in recharging costs.

The generator according to the invention not only provides a much greater increase in vehicle range than would additional battery capacity of the same size and weight, but also provides the added facility of enabling the vehicle, after a short delay, to be restarted and to travel under its own power after the battery charge has fallen so low that it stops.

#### WHAT WE CLAIM IS:—

1. A battery operated electrically propelled vehicle having provided thereon an electric motor to drive the road wheels of

the vehicle, a storage battery to supply electric current for driving the said motor, an electric generator and an internal combustion engine serving only to drive the electric generator, which generator is connected to the said storage battery so as to effect charging thereof, wherein the engine and generator are contained in a closed casing which is provided with a layer of sound insulating material and ventilated.

2. A battery operated electrically propelled vehicle according to Claim 1, wherein the internal combustion engine employs propane gas as fuel.

3. A battery operated electrically propelled vehicle according to Claim 1 or 2, wherein the internal combustion engine is governed to run at a fixed speed.

4. A battery charging set for use in a vehicle according to any preceding Claim comprising a sheet metal casing which is provided with a layer of sound insulating material and ventilated, an internal combustion engine and an electric generator mounted in said casing and means for conducting exhaust gases from said engine to a silencer outside said casing.

5. A battery charging set according to

Claim 4, wherein the sheet metal casing includes a bottom wall and a side wall hinged to the said bottom wall, a base slidable in guides on said bottom wall and carrying the engine and generator, and guide extensions formed on the internal surface of said side wall so that when the said side wall is moved to a position co-planar with the bottom wall, the engine and generator can be slid out on to said side wall for inspection and servicing.

6. A battery-operated electrically propelled vehicle substantially as described with reference to, and as shown in, the accompanying drawings.

7. A battery charging set for an electrically propelled vehicle according to Claim 1, substantially as described with reference to, and as shown in, Figure 3 of the accompanying drawings.

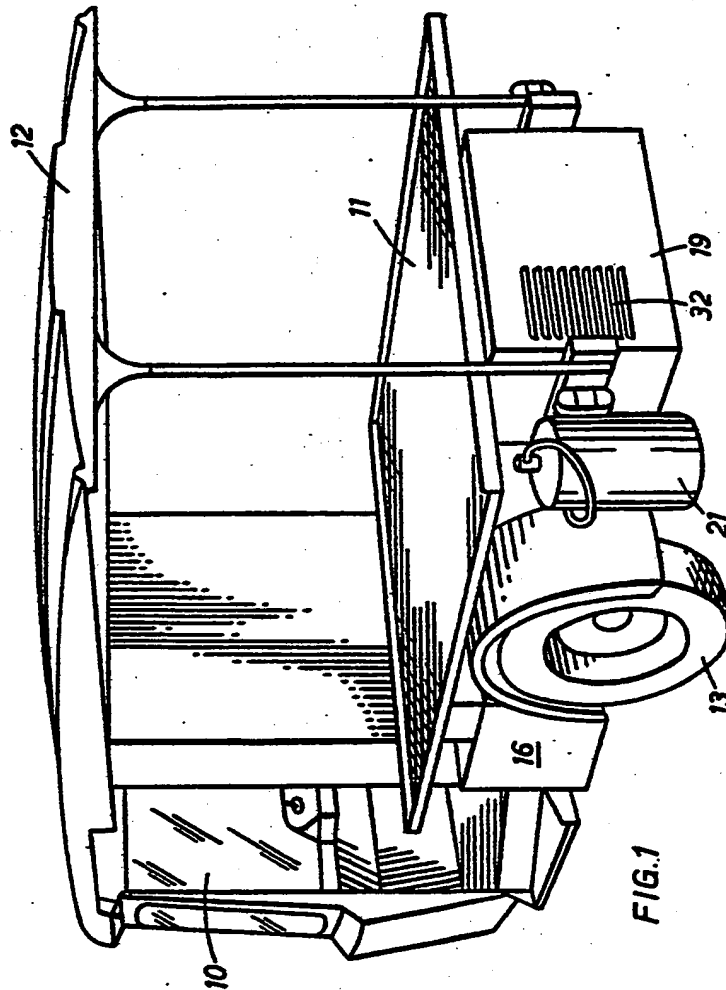
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COMPLETE SPECIFICATION

3 SHEETS

This drawing is a reproduction of  
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Sheet 1



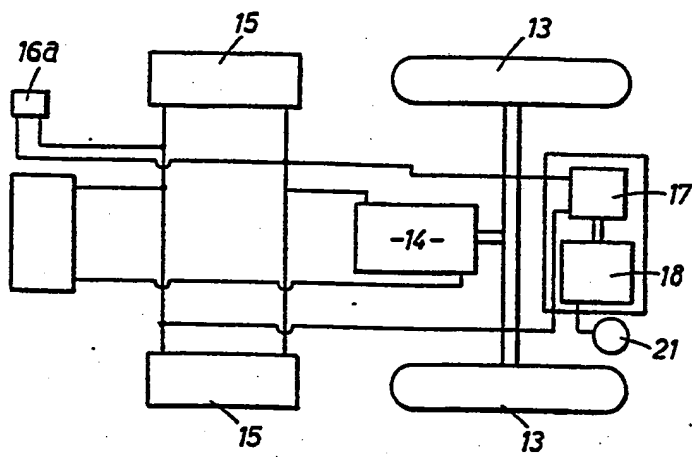


FIG.2

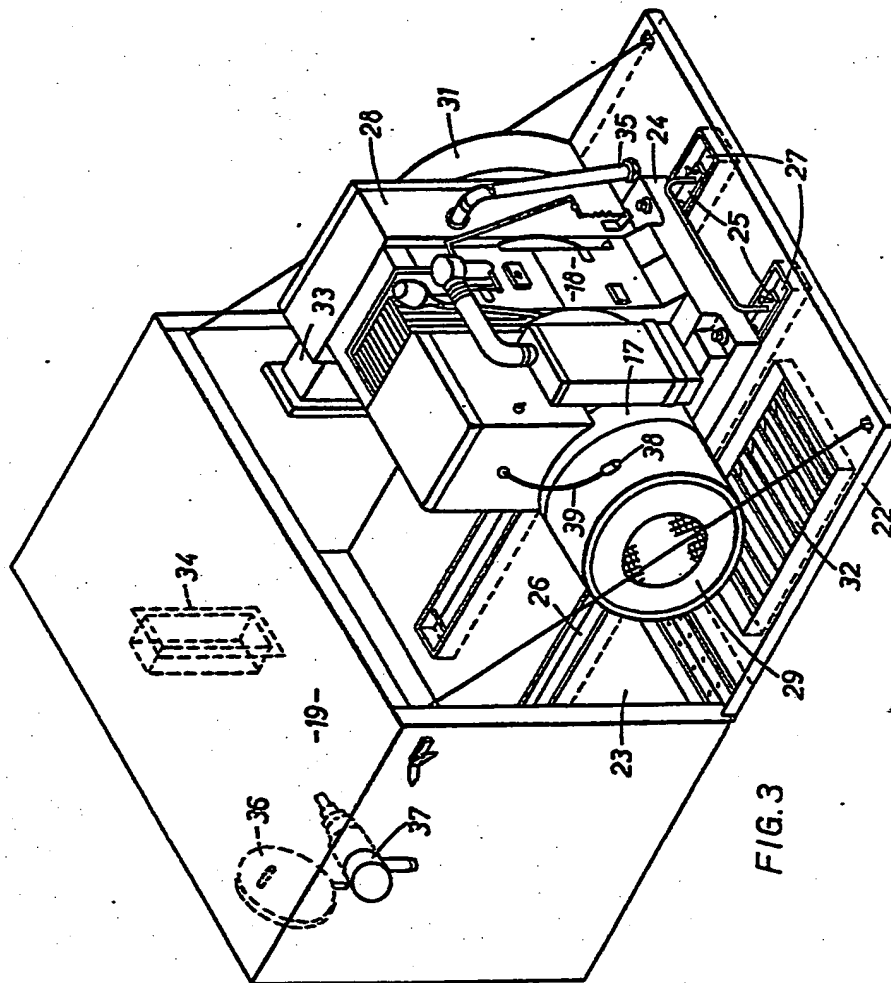


FIG. 3

